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Spectral Amplification Factors for Long-Period (3 to 10 s) Ground Motions in and around the Los Angeles Basin during the

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Mw7.2 El Mayor-Cucapah earthquake that occurred near the U.S.-Mexico border on April 4, 2010 is the first event providing a number of high-quality recordings to study long-period (3 to 10 s) ground motion amplification in and around the Los Angeles (LA) basin. In the LA basin, about 300 km away from the source, higher PGV values (~ 0.1 m/s) of long-period ground motions were observed relative to its surrounding area. By using more than 200 records from this event, spectral amplification factors of long-period ground motions were evaluated in and around the LA basin with respect to reference hard-rock sites. The main observations of this evaluation are the following: (1) Relative to the hard-rock reference sites, the maximum amplification is about a factor of 5 at 8 and 10 s periods in the central part of the LA basin, where depths of V_s 3.2 km/s and V_s 2.8 km/s isosurface according to the latest Southern California Earthquake Center Community Velocity Model (SCEC CVM-H 6.2) are correlated strongly with the observed high amplification; (2) in the San Gabriel valley, located northeast of the LA basin, the maximum amplification is about a factor of 3 at 8 s, and it is correlated well with the depth of V_s 1.5 km/s isosurface; (3) the largest amplification reached to a factor of 10 at the 6 s in the western part of the LA basin (Manhattan Beach), where the SCEC CVM-H 6.2 failed to provide the feature of the underground structures corresponding to the observed high amplification. The observations (1) and (2) mean that there is no single V_s isosurface that represents spatial variations of the long-period ground motion amplification observed in and around the LA basin. Finally, we compared the spectral amplification factors from the observations with those from the simulations using a simple point-source model and the SCEC CVM-H 6.2. Although the simulation results generally agree with the observations for spatial variation of amplification factors at long periods over 8 s, they tend to overestimate the intensity of amplification factors. Including Q-values and/or using detailed source model might improve the agreement between simulations and observations.

Keywords: long-period ground motions, Los Angeles basin, El Mayor-Cucapah earthquake, spectral amplification factors